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**GEOLOGY**

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Scorpionida  
The Holotype of *Mazonia woodiana*  
Meek and Worthen, 1868

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In 1868, Meek and Worthen described two scorpions from the Mazon Creek area as *Eoscorpium carbonarius* and *Mazonia woodiana*. This was the first announcement of Paleozoic scorpions from the Western Hemisphere, although they were previously known in Europe. Both specimens became very well known and remain so to this date. In particular, the specimen used as the holotype of *Mazonia woodiana* assumed considerable importance for taxonomic studies, for Meek and Worthen interpreted the preabdomen as having eight tergites, instead of the seven present in all other known scorpions, fossil or living. Petrunkevitch in 1913 and again in 1953 re-examined the holotype, still the only known specimen of *Mazonia woodiana*, and emphatically agreed with Meek and Worthen's early interpretation that the preabdomen was indeed composed of eight tergites. This interpretation, unfortunately, represented the main basis for the formation of significant higher taxa, in this particular case even to the formation of a suborder (Petrunkevitch, 1949, 1953 and 1955).

Wills in his remarkable and excellent paper on the anatomy of some Carboniferous scorpions (1960, p. 231) expressed strong and pertinent objections to the extra preabdominal tergite. Wills based his conclusions in part on a good cast of the holotype and suggested that the question might be settled by extracting another specimen of *Mazonia woodiana* from an ironstone concretion, as he had been able adroitly to do with various other scorpions. However, the holotype is the only specimen known of this controversial form, and, of course, it is impossible to apply the "Wills technique" to it. Moreover, its state of preservation is such that the question of the eight-segmented preabdomen can be easily solved, and some other details of considerable taxonomic importance revealed.

In December of 1963, I borrowed the holotype from the University of Illinois and studied it at the American Museum of Natural

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History. The results of this study follow in the description and summation given below. In brief, evidence is presented that is entirely at variance with the interpretation of an eight-segmented preabdomen as postulated first by Meek and Worthen and accepted by Petrunkevitch. Other morphological details of considerable taxonomic importance are also presented here for the first time.

#### ACKNOWLEDGEMENTS

I wish to thank Dr. Harold Scott of the University of Illinois for the loan of the holotype, and Dr. Norman D. Newell of the American Museum of Natural History for facilities and other courtesies extended to me during my visit and which made possible the note which follows. I also wish to thank Mr. R. W. Harris, Jr., of Dominion Oil Limited, Port-of-Spain, Trinidad, who kindly made the excellent photomicrographs included in Figures 91 to 101.

Order Scorpionida Latreille, 1817

Family Mazoniidae Petrunkevitch, 1913

Genus **Mazonia** Meek and Worthen, 1868

*Mazonia woodiana* Meek and Worthen, 1868. Figures 91-99.

*Mazonia woodiana* Meek and Worthen, 1868, Geol. Surv. Illinois, **3**, pp. 563-565, figs. A-D; Miller, 1877, Am. Palaeoz. Foss., p. 224; Peach, 1883, Roy. Soc. Edinburgh, Trans., **30**, p. 409, pl. 23, figs. 24, 25; Miller, 1889, N. Amer. Geol. Paleont., p. 571; Pocock, 1911, Palaeontogr. Soc., p. 11; Petrunkevitch, 1913, Conn. Acad. Arts Sci., **18**, pp. 54-56, pl. 3, fig. 13; Lehmann, 1944, Neues. Jahrb. Mineralogie, etc., pp. 177-185, figs. 1-4; Shimer and Shrock, 1944, Index Foss. N. Amer., p. 709, pl. 300, figs. 6-9; Petrunkevitch, 1949, Conn. Acad. Arts Sci., Trans., **37**, p. 132; 1953, Geol. Soc. Amer., Mem. **53**, pp. 12-13, figs. 11, 119; 1955, Treatise Inv. Paleont., *P*, Arthropoda 2, p. 70, fig. 38 (5); Wills, 1960, Palaeontology, **3**, pt. 3, p. 321; Dubinin, 1962, Fundamentals of Paleont., p. 428, figs. 1225, 1227; Størmer, 1963, Norske Vid.-Akad. Oslo, **8**, p. 116, fig. 44.

*Eoscorpis (Mazonia) woodiana* Meek and Worthen: Grabau and Shimer, 1910, N. Amer. Index Foss., **2**, p. 416.

The holotype is a fragmentary but very well preserved scorpion in dorsal aspect in a typical Mazon Creek ironstone concretion. Only the carapace, preabdomen and right pedipalp are preserved. The counterpart of the concretion has been lost. The part described here, and previously studied by Meek and Worthen (1868) and by Petrunkevitch (1913, 1953) is registered as No. X-491 in the Geological Museum of the University of Illinois. Inasmuch as there has been so much confusion and misinterpretation concerning this specimen,





FIG. 91. The holotype of *Mazonia woodiana* Meek and Worthen. Left: The specimen has been coated with ammonium chloride. Right: Natural, unretouched photograph.  $\times 2.7$ .



FIG. 92. *Mazonia woodiana* Meek and Worthen, schematic drawing of holotype with tergites numbered. Diagonal arrows indicate direction of displacement. Sternites shaded. A: central division line of lobostern abdominal plate.

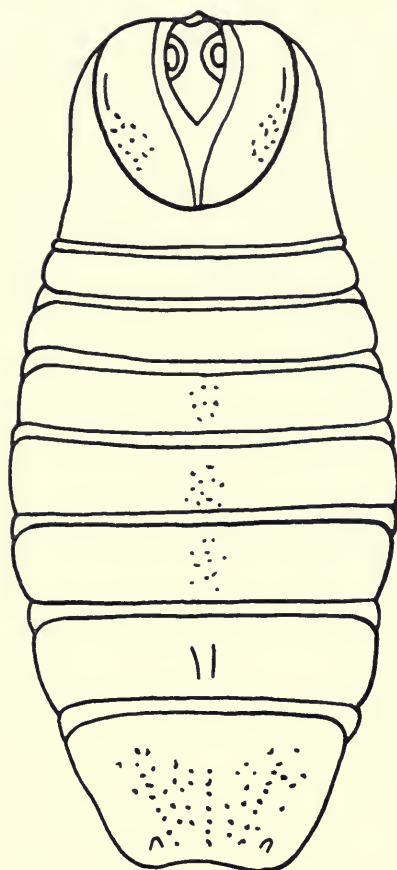


FIG. 93. Reconstruction of the dorsal side of the carapace and preabdomen of *Mazonia woodiana* Meek and Worthen.  $\times 2.7$ .

it is here redescribed. Certain important morphological parts are revealed for the first time and others are interpreted differently than before. Only one specimen of this species is now known.

For a proper understanding of this specimen it is necessary to keep in mind that it is broken into at least five disjointed parts. The largest of these units comprises the pedipalp, carapace and first two tergites. The second unit, consisting of the third to fifth tergites—all of which are in a fragmentary state—has been displaced to the left of the axis of the carapace. The third part is represented by a fragment of the sixth tergite which lies in normal left-right position with relation to the fifth tergite. The last section, and here is where the

cause for the confusion exists, comprises most of the sixth and seventh tergites, displaced posteriorly and rolled over to the right of the axis of the specimen. Thus the last tergite preserved, the seventh of the preabdomen, reveals only the central and left part of the tergite.



FIG. 94. Part of the integument of the middle part of the femur of the holotype showing both sides of integument (the darker areas include both ventral and dorsal surfaces). On the extreme left side are revealed three possible trichobothria in linear series, and cellular pore canal structures are clearly visible.  $\times 75$ .

This is proven by the ornamentation and will be described further below (p. 183). In between this section and the third are large fragments of the "sternites" (actually the anteriorly-hinged abdominal plates—see Størmer, 1963, p. 110) of the underside which lie diagonal to the axis of the scorpion and again show that displacement occurred, probably during ecdysis, moving the last two tergites to the posterior of the rest of the preabdomen and to the right of the axis.

#### PROSOMA

The carapace is preserved as a dorsal impression revealing most of the surface but is broken away at the extreme anterior, the left thoracic part, and the entire extreme right quarter. Enough, however, is present for an accurate description. The carapace is essentially sub-quadrate in general aspect, with round anterolateral margins, and with a short pointed protrusion along the central part of the anterior margin, now almost entirely broken away. The length of the carapace is 10.2 mm., but with the anterior process it probably measured 11.2 mm.; the width is only slightly greater.



FIG. 95. Socket of tactile hair (trichobothrium?) of specimen shown in Figure 94. This is the uppermost socket on the piece of integument which reveals the thick marginal or limbed rim.  $\times 600$ .

The central eye node, located anteriorly on the carapace, is the most conspicuous feature of this genus and this is lacrimiform, with the widest part anteriorly placed, and very protrudent above the carapace (see Meek and Worthen's 1868 original figures B-D, which are accurate). On the anterior blunt end of the node are two conspicuous, large, round, protrudent eyes, each surrounded by a very narrow fossa. The eyes measure 1.2 mm. in diameter, are separated from each other by a shallow sulcus, and because they are located on the elevated node were, therefore, capable of vision in all directions but with perhaps a blind spot very close (a few millimeters) to the dorsal part of the eyes where the eye node integument separated them. Inasmuch as this species appears to be aquatic (the "sternites" indicate that it belongs in the Lobosterni) one might speculate that the scorpion was admirably equipped to lie in wait for prey, covered by mud except for the protrudent eye node and with the large, strong pedipalps ready to seize the unwary.

The lacrimiform eye node is surrounded by a deep sulcus which reaches almost to the base of the carapace. Lying above this sulcus





FIG. 96. The socket for a tactile hair (trichobothrium?) of specimen shown in Figure 94, to reveal the thickened marginal rim. This is the lowest socket shown in Figure 94.  $\times 600$ .

is the elevated, shield-shaped cephalic area of the carapace. The thoracic area, to the rear, and the genal angles are flat. Along the posterior border is a rounded, narrow rim which extends to the genal angles. This has been mistaken for part of the first tergite, but it is definitely a prosomal basal rim.

At the side of the elevated cephalic area, toward the anterior part of the lateral margins, but well away from the margins and behind the central eyes, is a short, small, curved, narrow ridge which Petrunkevitch designated an "ocellar ridge" (1953, p. 13). This is a narrow, slightly incurved, cuticular thickening, but it does not follow that it is an "ocellar ridge," nor that it has any relation to lateral eyes, which are not present. Petrunkevitch states that lateral eyes were "probably present," but this is highly unlikely (unless they are ventral structures) and should not be seriously considered. I base my disagreement on two factors: First, in a very well preserved, although partly shattered, specimen such as this the lateral eyes would have been preserved if there were any. Secondly, the minute punctations that occur immediately behind the lateral ridges are dis-

tinely preserved and if the lateral eyes had been present they would also certainly have been preserved. Meek and Worthen (1868, p. 563) also were unable to find any lateral eyes. The function of the cuticular thickening, or lateral ridges, is unknown but it might have served as a point of attachment for some of the muscles which helped suspend or move the large and exceedingly long pedipalps. The position in relation to the trochanter of the left pedipalp indicates such a function.

Of the prosomal appendages, only parts of the left chelicera and the right pedipalp and one of the basal podomeres of the first walking leg are preserved. On the left side of the carapace are some parts of the legs which I could not interpret with any degree of certainty. Also at the left posterior is an elongated fragment which probably represents either a part of the coxa of the last walking leg or perhaps the posterior doublure of the carapace.

The chelicerae, hitherto unnoticed except for an undiagnostic basal fragment (Petrunkévitch, 1913, p. 56), are not well preserved except for the free ramus on the left side. This is preserved only in outline and occurs anterior to the carapace, thus, if not dislocated, indicating rather long chelicerae in this genus. This is likely as it would be in keeping with the very elongated pedipalps. The free



FIG. 97. Part of integument from the inner part of the prefemur of the holotype of *Mazonia woodiana* showing round perforation which may have represented a site for a tactile hair, possibly a trichobothrium. The rounded limbate lip of the perforation is clearly shown.  $\times 75$ .

ramus may be seen in Figures 91 and 92. It is hook-like and does not reveal any denticles, although these may remain embedded in the matrix. A fragment of the base of the chelicera is present but is too incomplete for description.

The pedipalps are notable for their extreme length. Only the three central joints are preserved; the chela unfortunately is not present, having been truncated by the edge of the nodule. The trochanter is an unusually long joint, wider distally than at the base and approximately half as long as the prefemur, although slightly wider.

The prefemur measures 12.9 mm. along the posterior edge, and 1.8 mm. across the midsection. The femur is narrower, but probably as long as the prefemur, although it is not complete. The entire pedipalp suggests a very long appendage with likely a very narrow hand and fingers. Little of the original chitin is left, but a small piece that was curling off the prefemur, near the trochanter, was taken off and mounted in Canada balsam. Another piece of integument was taken from the femur at midsection. These pieces of integument, which preserve the original colors, are dark rufous-brown, not unlike the color of some of the Recent scorpions. Photomicrographs reveal round perforations, bordered by a slight limbed lip, and these may well be sites for trichobothria (see figs. 94-99). No tactile hairs were preserved however.

The question whether aquatic scorpions of the Paleozoic may have developed trichobothria cannot be answered with any degree of certainty. The structures observed on the pedipalps of *Mazonia woodiana* are remarkably similar, at least in external cuticular structure, to the trichobothria on the same region of the pedipalps of Recent scorpions (see figs. 100-101), but may not actually represent trichobothria. Although only the stump of one of the setae was preserved, it appears likely that they were short, as noted in other Carboniferous scorpions. It is therefore possible that these structures (see also *Gigantoscrapio willsi* Størmer, 1963, p. 122) are either primitive trichobothria or trichobothria adapted for function in a water medium. Størmer (1963, p. 122) suggests the sensory adaption of the short, rigid pedipalpal setae for an aquatic medium.

#### PREABDOMEN

The most interesting part of the holotype is the preabdomen, but only because of the misinterpretation and attendant misconceptions that it has occasioned. In order to understand the morphology of this fossil it is important to keep in mind that it is highly shattered and



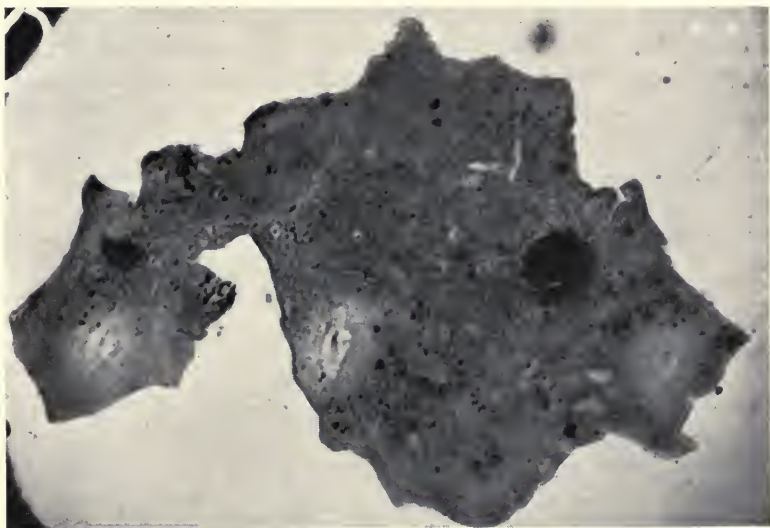


FIG. 98. Another fragment of the integument taken from the base of the pre-femur of *Mazonia woodiana* Meek and Worthen. Note dark round spot (see fig. 99) and canal and cellular structure.  $\times 75$ .

that, in the preabdomen alone, at least five distinct and separate parts have been moved enough to produce the erroneous interpretations that have led to wrong conclusions of major taxonomic importance. In fairness to previous writers, it must be admitted that the fossil is quite misleading, inasmuch as the various sections have been displaced in such a manner as to cause the miscount of eight preabdominal tergites.

The tergites of *Mazonia woodiana* are characterized by an unusually prominent anterior transverse ridge such as is well known in present-day scorpions, e.g., *Tityus*, *Broteochactas*, *Hadrurus* and *Vejovis*. In *Mazonia* this transverse ridge is highly developed, much as in such Eurypterida as *Eurypterus*, *Erieopterus* and *Buffalopecterus*. It is present in an equally exaggerated state in the Silurian *Proscorpius*, but is not developed in the Silurian *Archaeophonus* or *Palaeophonus*. Similarly, in Carboniferous scorpions the anterior ridge is developed in *Buthiscorpius* and *Mazoniscorpio*, but not in many others.

The first tergite of the holotype of *Mazonia woodiana* is preserved so that most of the central part and a fragment of the extreme right edge are present. This tergite may have been moved, possibly during ecdysis, so that the anterior ridge, if present on this tergite, was pushed under the carapace. It could well be, however, that the first

tergite does not have an anterior transverse ridge, a condition known in many eurypterids that have the ridges developed on the other tergites. I subscribe to the latter possibility. The ridge that appears to be the anterior transverse ridge of the tergite is actually the rounded basal ridge of the carapace.

The anterior part of the right half of the second tergite is preserved attached to the first. Both of these tergites preserve the exterior surface, but neither reveals any ornamentation. There is a jagged break between the second tergite and the next unit that follows. This is composed of parts of the central and right portion of the third and fourth tergites and the anterior ridge of the fifth, all retaining the external surface. The entire unit has been displaced slightly, but not significantly, to the left of the cephalic axis, as shown by the groups of small tubercles which undoubtedly occurred along the central axis.

In line with the anterior transverse ridge of the fifth tergite, is a fragment of the extreme right side of the tergite, preserved as an impression of the inner surface. This piece is completely isolated from the unit that retains the rest of the anterior ridge of this tergite.

Also isolated, but apparently not greatly displaced from the preceding tergite, is the extreme right side of the sixth tergite. A very steep side is present at the edge. This portion is preserved as an impression of the ventral or inner side of the tergite.

The last unit comprises parts of the sixth and seventh tergites, diagonally displaced from the central axis considerably to the posterior and right. The two "sternites" preserved, which will be described below, show this same diagonal displacement. The unit actually is composed of most of the sixth and seventh tergites, but it also includes a small fragment that occurs to the right of the main fragments. The main fragment preserves the dorsal side of the tergites, whereas the isolated piece of the sixth tergite on the right side is an impression of the ventral surface.

The sixth tergite is preserved so that the extreme left side is revealed and most of the central part. A narrow longitudinal ridge is present at midsection, although it does not reveal any of the central tubercles noted on the third and fourth tergites. The entire unit has not only been displaced diagonally, but partly rolled over, as attested by the incurved and steep side of the isolated fragment of the sixth tergite on the right side. This displacement and the accompanying rolling over are also attested by the exposure of the left side edges of the very prominent anterior ridge of the last preabdominal (7) tergite.

Another good indication of the various differential displacements that the preabdomen has suffered can be seen by the isolated line at the left of the abdomen. This actually represents the extreme edge

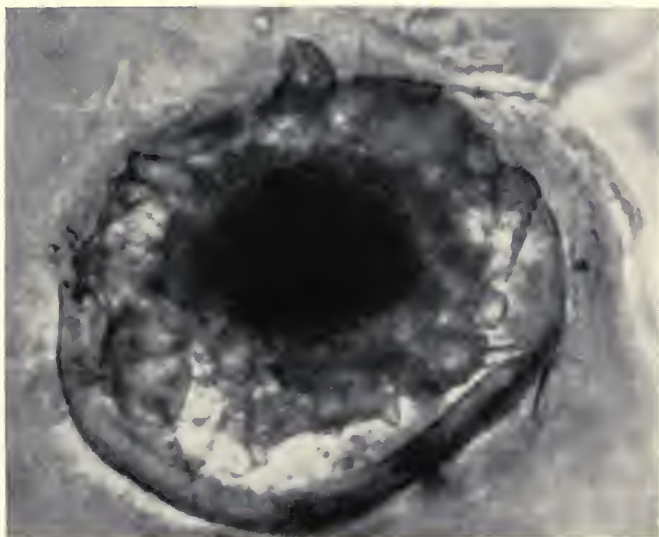


FIG. 99. This represents the dark round spot on the piece of integument shown in Figure 98, which reveals a socket for a tactile hair (trichobothrium?). The raised marginal lip of the socket as well as the stump (dark area) of the seta can be clearly defined.  $\times 600$ .

of the anterior left side of the preabdomen. This line probably represents the original edges of the underside in cross-section and is attached to the unit containing the carapace. I suspect that the anterior sternites and other ventral structures are therefore embedded inside of the concretion. The original outline of the left side may be reconstructed by following the dotted line (see fig. 92). A similar line starting at the extreme right fragment of the first tergite gives the proportions of this interesting scorpion and will reveal in a striking manner the great displacements that have occurred. The reconstruction (fig. 93) is based on these proportions, and reveals a very robust scorpion.

The seventh tergite is the most interesting of all because of its very distinct and unusual ornamentation. It is noteworthy also because of the unusually thick and wide anterior transverse ridge, which may best be seen at the left side of the tergite. The entire tergite appears normal, that is, it probably was subconical in shape. Scat-

tered pustules occur, but at least two indistinct, though nevertheless quite noticeable, rows of punctae are present. A very large solitary pustule occurs at the left rear part and probably is duplicated on the

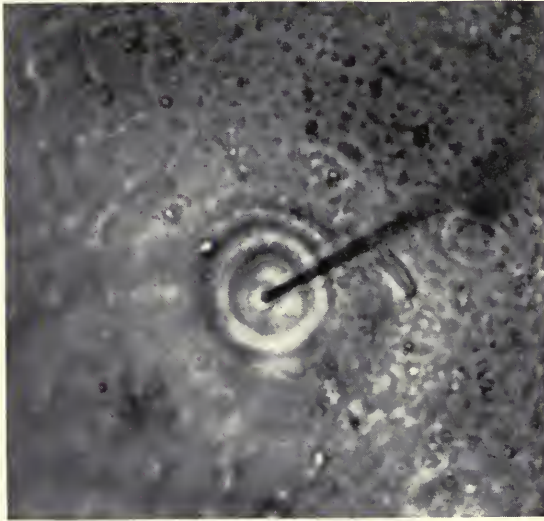


FIG. 100. Trichobothrium of the living scorpion *Tityus trinitatis* Pocock from Trinidad, from the basal part of the prefemur, showing cup-shaped area, tactile seta, and raised marginal rim, not greatly unlike that in the Pennsylvanian *Mazonia woodiana* Meek and Worthen.  $\times 75$ .

right, but that side has been rolled over. I believe that there are three rows of punctae or perhaps four, as postulated by Petrunkevitch in his restoration. Either way, this again emphasizes the great displacement of these last two tergites. However, I disagree with Petrunkevitch that the caudal tergites, or postabdomen, must have been slender as in *Dolichophonus*. I should surmise from the heavy construction of this scorpion (see restoration, fig. 93) that the caudal segments were also stoutly developed. There is no correlation however in modern scorpions regarding the stoutness of the appendages in comparison to the proportions of the opisthosoma.

Between the main body of the sixth and the fourth tergites are two ventral abdominal plates, or "sternites." Meek and Worthen (1868) show these in their figure but do not describe them. Petrunkevitch (1913, 1949, 1953, 1955) neither figures nor describes these important structures and therefore it must be assumed that these authors either did not recognize these as the "sternites" or else assumed that they



were dorsal structures. The two "sternites" are shaded in Figure 92, and may be seen on the photographs in Figure 91. Neither shows any trace of ornamentation or stigmata, although these would certainly have been preserved if they had occurred. The anterior diagonal "sternite" is nearly complete and clearly divided into two halves. The lower half (on a diagonal) is partly covered at the inner part, but the other part reveals a distinct, rounded, inner edge (see A on fig. 92). This is positive evidence of the split, lobostern, abdominal plates. The plate posterior to the two broken ones described shows the much greater length that is characteristic of these long, overlapping lobostern plates.

Measurements of the tergites of the abdomen of this specimen are difficult because of their fragmentary condition, and the telescoping of some. Nevertheless some measurements are possible, but should be accepted with considerable reservations. I suspect that the greatest width of the preabdomen occurs at the central part of the fourth tergite. With these reservations, the following measurements are given as approximately correct (those in *italics* represent actual dimensions; the rest are reconstructed):

TERGITE	LENGTH (in mm.)
No. 1	<i>3.5</i>
No. 2	3.8
No. 3	4.0
No. 4	4.1
No. 5	4.3
No. 6	<i>4.6</i>
No. 7	8.0

#### SUMMATION

The preabdomen of the holotype has caused considerable confusion, and led Meek and Worthen in 1868 (p. 563) to suspect that it retained eight tergites, because there was "space enough between the anterior, or seventh one seen, and the cephalothorax, for an eighth one."

Petrunkévitch (1913, p. 36), after reviewing the holotype, concluded that eight tergites composed the preabdomen and therefore he keyed out the genus *Mazonia* as follows: "Seventh abdominal tergite similar to the preceding ones, eighth similar to the seventh of recent scorpions." In the same publication (p. 55) he speculated on the number of caudal segments inasmuch as he accepted the count of eight for the preabdomen. However, on page 26 he expressed some doubt as to *Mazonia* being a true scorpion. In 1953 (p. 13), after another examination of the holotype, any doubts that Petrunkévitch

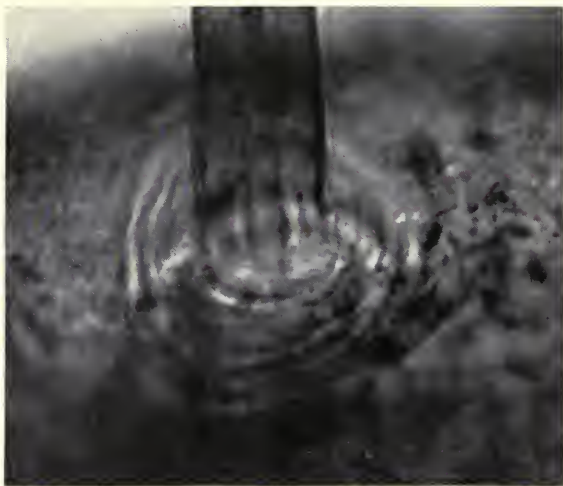


FIG. 101. Base of the trichobothrium from the base of the prefemur of *Tityus trinitatis* Pocock, viewed from the side to show the base of the seta and marginal rim of socket.  $\times 600$ .

may have had concerning his earlier interpretation of the presence of eight preabdominal tergites were dispelled; he asserted (*italics by Petrunkevitch*): "On the other hand patient further development of the specimen revealed additional features in the structure of the carapace and *definitely confirmed the presence of eight preabdominal tergites.*" The incorrect interpretation later led to the establishment of a suborder (Petrunkevitch, 1949, p. 127) and lesser taxa. Later Størmer (1963, p. 116, text-fig. 44), following Petrunkevitch's assertive but erroneous analysis, applied it to an otherwise excellent comparison between the Scorpionida and Eurypterida. There is no question concerning the pregenital or prenatal tergite; however, there is no certainty that this (first) tergite will be found in the adult scorpions (see below) except possibly in the pre-scorpionid progenitors.

The preabdomen of *Mazonia* comprises seven tergites, precisely the same number present in all scorpions known, whether fossil or living. Although the holotype is fragmentary, the parts preserved are very well preserved, and unless one understands and takes into consideration that the specimen is in a highly fragmentary state, preserved in at least five major separate sections, mistakes are bound to occur.

It is not the purpose of this short note to propose significant changes in the systematics of the Scorpionida. I am at present en-

gaged in a study of several Lower Paleozoic scorpions which reveal considerable new data, and would prefer to await conclusion of that study before proposing certain necessary changes. Obviously, the suborder Protoscorpionina Petrunkevitch, 1949, is at least ill-conceived, and perhaps other groups based in part on the eight-segmented preabdomen or the "hidden tergite" are also illusory.

In this respect, I think it is well to quote Wills (1960, p. 321) concerning his essentially correct discussion of *Mazonia woodiana* made from a rubber cast (Wills, however, suspected that the first tergite might have been intersegmental tissue). "If the extra tergite should prove to be fictional, another of Petrunkevitch's (1955, p. P70) superfamilies and families would disappear. Also his whole suborder Protoscorpionina is based on the Carboniferous *Mazonia woodiana* and on the Silurian genera *Palaeophonus*, *Dolichophonus* and *Proscorpius*, which three, he states, have the first tergite (of the supposed seven characterizing his suborder) concealed under the carapace. None, however, of the published figures of these three forms shows more than six mesosomatic tergites, and the transverse mark across the hinder part of the carapace, which is the sole evidence for his statement about the concealed tergite, can be matched in many Recent scorpions and probably in Carboniferous ones also (p. 285). I therefore regard as ill-founded his 1955 diagnosis of the family Palaeophonidae 'First abdominal tergite concealed under carapace, its anterior edge indicated by a transverse furrow.' "

Genera other than *Mazonia* included by Petrunkevitch (1955) under the suborder Protoscorpionina, "Scorpions with first abdominal segment persisting in the adult and abdomen with eight tergites," are *Dolichophonus*, *Palaeophonus* and *Proscorpius*, although in each it is clear that only seven tergites compose the preabdomen. In the case of *Proscorpius*, the posterior band-like swelling (see Kjellesvig-Waering, 1964, pl. 2, fig. 3) may be a reflection of the posterior doublure of the carapace, or merely a raised posterior area of the carapace, among other possibilities. A similar basal doublure is found in all eurypterids, and it is present in a reduced state in living or terrestrial scorpions. As Wills (1960, p. 321) has stated, the swelling at the base of the carapace is known in both Carboniferous and Recent scorpions. The same conclusion seems to apply where Petrunkevitch (1953, p. 11, fig. 7) illustrates a band-like part at the base of the carapace of *Dolichophonus loudonensis* (Laurie). This indeed seems to be the case, as Petrunkevitch (1953, p. 8, fig. 8) clearly restores *Palaeophonus caledonicus* Hunter correctly as a form with the usual seven

preabdominal tergites, though he includes it in the suborder Proto-scorpionina. Therefore, the main support for the presence of the extra tergite in fossil forms is based on the highly shattered holotype of *Mazonia woodiana* and this has been shown here to have a preabdomen that consists of the usual seven tergites. *Mazonia woodiana* Meek and Worthen should be considered a typical member of the Lobosterni, and should possibly be grouped together with genera such as *Lichnophthalmus*, *Typhloscorpis* and *Benniescorpis*. In my opinion, *Alloscorpis wordingleyi* (Woodward) is a *Mazonia*.

If, as Petrunkevitch claims, the covered, and therefore invisible, pregenital tergite lies hidden under the carapace in early Paleozoic scorpions, there is no reason, other than geological age, to claim that all adult scorpions in the Paleozoic also retained this elusive and imaginary tergite. This reasoning could be applied not merely to *Palaeophonus*, *Dolichophonus* or *Proscorpis*, but to all fossil scorpions. However, it is known that all Paleozoic scorpions clearly retain the usual seven tergites in the preabdomen and nowhere is there evidence of eight tergites in the adult, or in neonatal, scorpions. The theory as pertains to the adult scorpions, if at all valid, as well as the classification proposed by Petrunkevitch for these early forms, must necessarily await phylogenetic evidence in the form of undoubted fossil specimens that may furnish the necessary morphological data. That evidence cannot be furnished by *Mazonia woodiana* Meek and Worthen or any known fossil scorpion.

The fact that some embryonic scorpions (all?) have been found to retain a pregenital tergite is insufficient reason to expect that any of the older fossil scorpions, that is, animals that have reached the state of evolution in which they are recognized as Scorpionida Latreille 1817, would have a preabdomen of eight tergites followed by a postabdomen of the usual five tergites. Certainly, in the closely related Eurypterida, neonates consistently reveal a much smaller number of tergites than later stadia and early scorpions may well have had a similar development. Because the known Paleozoic scorpions, whether from the Silurian, Devonian or Carboniferous, had by that time established the definite characteristics that persist to the present, it would be surprising if these fossil scorpions did not also have a rather similar ontogeny; therefore, the pregenital tergite should be expected in the embryo, and not in the adults of these Paleozoic scorpions. In short, inasmuch as the macroevolution of the scorpions had already been established in the Silurian, it should follow that similar advancement had also progressed in the embryonic



development. The pregenital tergite in modern scorpions may more properly represent a remnant of the pre-scorpion ancestor, rather than an eighth preabdominal tergite of the ancestral adult scorpions. The question, therefore, is: when in scorpion evolution was the pregenital tergite present in the adult? To date the fossil evidence does not answer the question, as all scorpions so far known retain a seven-segmented preabdomen.

## REFERENCES

DUBININ, W.

1962. Handbook of the Paleontology and Geology of the U.S.S.R., 9, part Scorpionida, pp. 423-433, figs. 1220-1260.

GRABAU, A. W. and H. W. SHIMER

1910. North American Index Fossils. 2 vols., 909 pp., 1937 figs.

KJELLESVIG-WAERING, E. N.

1966. Silurian Scorpions of New York. Jour. Paleont., 40, pp. 359-375. Pls. 42-44; 18 text-figs.

MEEK, F. B. and A. H. WORTHEN

1868. Illinois Geol. Surv. Rept., 3, Paleontology, Genus *Mazonia*, pp. 563-565, 4 figs.

MILLER, S. A.

1877. Palaeozoic Fossils: A Catalogue of the Genera and Species, etc. 253 pp., Cincinnati, Ohio. Privately published.

1892a. North American Geology and Palaeontology. 664 pp., 1194 figs.

1892b. First Appendix, pp. 665-718, figs. 1195-1265. Cincinnati, Ohio. Privately published.

PEACH, B. N.

1883. On some new species of fossil Scorpions from the carboniferous rocks of Scotland. Trans. Roy. Soc., Edinburgh, 30, pp. 397-412, pls. 22-23.

PETRUNKEVITCH, A.

1913. A Monograph of the Terrestrial Palaeozoic Arachnida of North America. Conn. Acad. Arts Sci., Trans. 18, pp. 1-137, pls. I-XIII, text-figs. 1-88.

1949. A Study of Palaeozoic Arachnida. Conn. Acad. Arts Sci., Trans., 37, 315 pp., 83 pls.

1953. Paleozoic and Mesozoic Arachnida of Europe. Geol. Soc. America, Mem. 53, 128 pp., 58 pls.

1955. Treatise on Invertebrate Paleontology, pt. P, Arthropoda 2, Arachnida, pp. P44-P162, figs. 31-116.

SCUDDER, S. H.

1885. Arachnoidea in Zittel's Handbuch der Palaeontologie, I Abth., Bd. 2.

1895. Notes upon myriapods and arachnids found in sigillarian stumps in the Nova Scotia coal field. Canad. Geol. Surv., Contrib. Paleont., 2, pt. I, art. 3, pp. 57-66, pls. IV-V.

1900. Zittel's Textbook of Paleontology, translation by Eastman. London.

SHIMER, H. W. and R. R. SHROCK

1944. Index Fossils of North America, 837 pp., 303 pls., John Wiley & Sons, New York. Part on Scorpionida, p. 709, pl. 300, figs. 6-11.

STØRMER, L.

1963. *Gigantoscrapio willsi*, A new scorpion from the Lower Carboniferous of Scotland and its associated preying microorganisms. Skr. Norske Vid.-Akad., Oslo; Mat.-Naturv. Kl., Ny Ser., No. 8, 171 pp., 22 pls., 45 text-figs.

WILLS, L. J.

1959. The External Anatomy of some Carboniferous "Scorpions," Part 1. Palaeontology, 1, pt. 4, pp. 261-282, pls. 49-50.

1960. The External Anatomy of some Carboniferous "Scorpions," Part 2. Palaeontology, 3, pt. 3, pp. 276-332, pls. 46-57

















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